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(54) Transmitting system, transmitting apparatus, recording and reproducing apparatus

(57) A transmitting system which comprises a transmission line, a transmitting apparatus connected to the transmission line, and a receiving apparatus connected to the transmission line, and transmits data between the transmitting apparatus and the receiving apparatus, wherein the transmitting apparatus comprises packet compressing means which receives input data comprising plural packets having identifiers as an input, identifies packets to be discarded and effective packets according to the identifiers, and outputs compression information indicating the number of continuously discarded packets and the effective packets to the transmission line, and the receiving apparatus comprises packet restoring means which receives the compression information and the effective packets which have been output from the transmitting apparatus, generates ineffective packets which are as many as the discarded packets, and outputs the ineffective packets and the effective packets.

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Description

FIELD OF THE INVENTION:

[0001] The present invention relates to a transmitting system, a transmitting apparatus, a recording and reproducing apparatus, and a recording apparatus, for transmitting/recording a stream comprising plural packets according to MPEG(Moving Picture Experts Group)2.

BACKGROUND OF THE INVENTION:

[0002] It has been well known that a TS (transport stream) according to MPEG2 is a stream comprising compressed digital video, compressed digital audio, and the like. The TS is used in digital broadcasting, and contains multiplexed plural programs. Hereinafter, "TS" always refers to the TS according to MPEG2 (MPEG2 TS). MPEG2 is defined in ITU-T H.222.0 (ISO/IEC 13818-1) "Generic Coding of Moving Pictures And Associated Audio Information".

[0003] Figure 3(a) and 3(b) show the TS. Shown in figure 3(a) are TS packets. The TS comprises a set of TS packets which are fixed in length (188 byte). The TS packets each includes plural fields, i.e., 8-bit Sync Byte, a 13-bit PID (Packet Identifier), a 4-bit CC (Continuity Counter),an AF (Adaptation Field) (0-184 bytes), and a payload (0-184 bytes), and so forth. Information irrelevant to the present invention is not discussed herein. Information in respective fields of the TS packet will be discussed below.

[0004] The Sync Byte (8 bits) is positioned at the head of the TS packet, and is 0x47 (0x: hexadecimal numeral), which is used for detecting the head of the packet.

[0005] The PID (13 bits) is used for identifying payload data. According to plural PIDs, plural programs contained in one TS can be identified. PID=0x1fff indicates that the corresponding TS packet is an ineffective (null) packet.

[0006] The CC (4bit) increases one by one among the TS packets of the same PID. In some cases, neighboring TS packets of the same PID take the same CC value. They are called a "Duplicated Packet". When the Duplicated Packet is transmitted, two TS packets of the same content are sequentially transmitted.

[0007] The AF (0-184 bytes) is used for storing additional information.

[0008] The Payload (0-184 bytes) is used for storing actual data, the length of which is determined by the length of the AF.

[0009] In addition, the TS contains PCRs (Program Clock References) inserted at regular intervals. The PCR is information which a decoder at a receiving end uses so as to set the value of a reference time STC (System Time Clock) to the value intended by a transmitting end. Therefore, it is required that the PCR arrive at the receiving end at a timing as intended by the transmitting end.

[0010] When the TS is used in the digital broadcasting, as shown in figure 3(b), an error correction code is sometimes added after the TS packet. The typical code length of the error correction code is 16 bytes, and the TS packet and the error correction code (204 bytes in total) is transmitted as a unit. In some cases, the error correction code (16 byte) is dummy data.

[0011] A description will be given of a prior art transmitting system which transmits the TS described above.

[0012] One example of the prior art transmitting system is a system which adopts an adaptive clock system using an ATM (Asynchronous Transfer Mode). This is described in detail in Practical MPEG Text (P218-221), published by Aski Publishing Company.

[0013] Figure 8 shows this prior art transmitting system. In figure 8, reference numerals 81, 82, 83, 821, 822, and 823 designate a transmitting apparatus, a receiving apparatus, a transmission line, receiving means, storage means, and PLL (phase-locked loop), respectively. The MPEG2 TS is input to the transmitting apparatus 81, the transmitting means 811 of which transmits the input data to the transmission line 83. The transmission line 83 is an ATM network. When transmitting input data on the transmission line 83, some variance of delay occurs. The receiving means 821 of the receiving apparatus 82 receives data on the transmission line 83. The receiving means 821 stores the received data in the storage means 822. The storage means 822 is an FIFO (first-in, first-out) memory, and outputs the input data in synchronization with the output clock. The PLL 823 adjusts the speed of the output clock so that the amount of data stored in the storage means 822 is kept constant. To be specific, when the amount of stored data is larger than a predetermined value, the PLL 823 makes the speed of the output clock higher, while when the amount is smaller than the predetermined value, the PLL 823 makes the speed lower.

[0014] As described above, in the prior art transmitting system, although some variance of delay occurs on the transmission line 83, the PLL 823 and the storage means 822 of the receiving apparatus 82 make it possible to decode the data correctly.

[0015] However, in the prior art method, all the packets (programs) contained in the input data are transmitted even for the case where only a part of them needs to be transmitted. This makes it impossible to realize effective use of the band of the transmission line.

[0016] The similar problem occurs in the recording and reproducing apparatus.

SUMARY OF THE INVENTION:

[0017] It is an object of the present invention to provide a transmitting system which is capable of transmitting data in such a manner that data to be transmitted on a transmission line can be reduced and a stream can

be reproduced correctly when it is received.

[0018] It is another object of the present invention to provide a recording and reproducing apparatus which is capable of recording and reproducing data in such a manner that data to be recorded in a recording medium can be reduced and the stream can be reproduced correctly when it is reproduced.

[0019] Other objects and advantages of the invention will become apparent from the detailed description that follows. The detailed description and specific embodiments described are provided only for illustration since various additions and modifications within the spirit and scope of the invention will be apparent to those skill in the art from the detailed description.

[0020] According to a first aspect of the present invention, in a transmitting system which comprises a transmission line, a transmitting apparatus connected to the transmission line, and a receiving apparatus connected to the transmission line, and transmits data between the transmitting apparatus and the receiving apparatus, the transmitting apparatus comprises: packet compressing means which receives input data comprising plural packets having identifiers as an input, identifies packets to be discarded and effective packets according to the identifiers, and outputs compression information indicating the number of continuously discarded packets and the effective packets to the transmission line, and the receiving apparatus comprises: packet restoring means which receives the compression information and the effective packets which have been output from the transmitting apparatus, generates ineffective packets which are as many as the discarded packets, and outputs the ineffective packets and the effective packets. Therefore, it is possible to realize a transmitting system which is capable of reducing data to be transmitted on the transmission line and reproducing the stream correctly when it is received.

[0021] According to a second aspect of the present invention, in the transmitting system of the first aspect, the transmitting apparatus further comprises: identifying means which receives a fixed clock and the input data synchronized with the fixed clock as inputs, identifies the packets to be discarded and the effective packets according to the identifiers, and outputs identification signals each indicating that a packet is either the effective packet or the packet to be discarded; and counting means for counting the number of continuously discarded packets from the identification signals.

[0022] According to a third aspect of the present invention, in the transmitting system of the second aspect, the input data to the transmitting apparatus is a transport stream according to MPEG2, and the identification signals each indicates that the packet is either the packet to be discarded or the effective packet according to the corresponding packet identifier.

[0023] According to a fourth aspect of the present invention, in the transmitting system of the third aspect, the output means of the transmitting apparatus inserts the compression information for replacing a continuity counter of an effective packet positioned immediately after the compression information, and the packet restoring means of the receiving apparatus uses data in the continuity counter as the number of the continuously discarded packets, and replaces the continuity counter with the number which increases one by one among the packets of the same packet identifier. Therefore, when transmitting TS packets contained in the MPEG2 transport stream, it is possible to further reduce data to be transmitted.

[0024] According to a fifth aspect of the present invention, in the transmitting system of the second aspect, the transmitting apparatus, when the value of the counting means reaches a predetermined value, outputs either the packet to be discarded or the ineffective packet into which the discarded packet has been converted, as the effective packet. Therefore, it is possible to make fixed-length data of the number of continuously discarded packets.

[0025] According to a sixth aspect of the present invention, in the transmitting system of the first or second aspect, the receiving apparatus further comprises: a storage for storing the ineffective packets and the effective packets as data and outputting the packets in synchronization with a clock in the order in which the packets are input; and an adaptive clock generating device for outputting the clock so that the amount of the data stored in the storage is kept constant. Therefore, it is possible to reproduce the clock synchronized with the data from the transmitting end.

[0026] According to a seventh aspect of the present invention, in the transmitting system of the sixth aspect, the adaptive clock generating device outputs the clock so that the amount of the data stored in the storage when one effective packet is input thereto is kept constant. Therefore, it is possible to reproduce the clock more correctly.

[0027] According to an eighth aspect of the present invention, in the transmitting system of the first or second aspect, the receiving apparatus further comprises: a storage for storing the effective packets and the compression information as data and outputting the data in the order as entered; packet restoring means for reading the data from the storage, outputting the ineffective packets when there is no data in the storage, and outputting the ineffective packets which are as many as the discarded packets of the number indicated by the compression information and the effective packets when there is data in the storage, the ineffective packets and the effective packets being output in synchronization with the clock; a counter for increasing its value by (the number of the discarded packets indicated by the compression information) × (packet length) when the compression information is input thereto, increasing its value by the packet length of the effective packet when the effective packet is input thereto, and decreasing its value by one when the clock is input thereto; and an

adaptive clock generating device for outputting the clock so that the value of the counter is kept constant. Therefore, it is possible to realize a small-scale circuit including a storage of a smaller capacity.

[0028] According to a ninth aspect of the present invention, in the transmitting system of the eighth aspect, the adaptive clock generating device outputs the clock so that the value of the counter counted when the effective packet is received is kept constant. Therefore, it is possible to reproduce the clock more correctly.

[0029] According to a tenth aspect of the present invention, a transmitting apparatus for processing input data and outputting the processed data to a transmission line, comprises: identifying means which receives a fixed clock and an MPEG2 transport stream as input data comprising plural packets having identifiers as inputs, identifies packets to be discarded and effective packets according to the identifiers, and outputs the effective packets and identification signals each according to a packet identifier of either the packet to be discarded or the effective packet; counting means for counting the number of continuously discarded packets from the identification signals; and output means for outputting compression information indicating the number of continuously discarded packets which has been counted by the counting means and the effective packets to the transmission line.

[0030] According to an eleventh aspect of the present invention, in the transmitting apparatus of tenth aspect, the output means inserts the compression information for replacing a continuity counter of the effective packet positioned immediately after the compression information.

[0031] According to a twelfth aspect of the present invention, a transmitting apparatus for processing input data and outputting the processed data to a transmission line, comprises: identifying means which receives a fixed clock and the input data comprising plural packets having identifiers which is synchronized with the fixed clock as inputs, identifies the packets to be discarded and the effective packets according to the identifiers, and outputs identification signals each indicating that a packet is either the effective packet or the packet to be discarded; counting means for counting the number of continuously discarded packets from the identification signals; and output means for outputting compression information indicating the number of continuously discarded packets which has been counted by the counting means and the effective packets to the transmission line; the output means outputting either the discarded packet or the ineffective packet into which the discarded packet has been converted, as the effective packet, when the value of the counting means reaches a predetermined value.

[0032] According to a thirteenth aspect of the present invention, in a recording and reproducing apparatus which comprises a recording apparatus for processing input data and recording the processed data in a recording medium, and a reproducing apparatus for reading the data from the recording medium, the recording apparatus comprises: identifying means which receives a fixed clock and an MPEG2 transport stream as input data comprising plural packets having identifiers which is synchronized with the fixed clock as inputs, identifies packets to be discarded and effective packets according to the identifiers, and outputs the effective packets and identification signals each according to a packet identifier of either the packet to be discarded or the effective packet; counting means which increases its value by one when the identification signal indicates that the packet is the packet to be discarded, and outputs its value as compression information and then sets its value to zero when the identification signal indicates that the packet is the effective packet; and recording means which records the compression information output from the counting means and the effective packets in the recording medium; and the reproducing apparatus comprises: packet restoring means which reads the compression information indicating the number of discarded packets and the effective packets from the recording medium, generates ineffective packets as many as the discarded packets, and outputs the ineffective packets and the effective packets. Therefore, it is possible to realize a recording and reproducing apparatus which is capable of reducing data to be recorded in the recording medium and reproducing the stream more correctly when it is reproduced.

[0033] According to an fourteenth aspect of the present invention, in the recording and reproducing apparatus of the thirteenth aspect, the recording means of the recording apparatus inserts the compression information for replacing a continuity counter of an effective packet positioned immediately after the compression information, and the packet restoring means of the receiving apparatus uses data in the continuity counter as the number of the continuously discarded packets, and replaces the continuity counter with the number which increases one by one among the packets of the same packet identifier. Therefore, when recording TS packets contained in the MPEG2 transport stream, it is possible to reduce data to be recoded.

[0034] According to a fifteenth aspect of the present invention, in a recording and reproducing apparatus which comprises a recording apparatus for processing input data and recording the processed data in a recording medium, and a reproducing apparatus for reading the data from the recording medium, the recording apparatus comprises: identifying means which receives a fixed clock and input data comprising plural packets having identifiers which is synchronized with the fixed clock as inputs, identifies packets to be discarded and effective packets according to the identifiers, and outputs the effective packets and identification signals each indicating that a packet is either the packet to be discarded or the effective packet; counting means which increases its value by one when the identification signal

indicates that the packet is the packet to be discarded, and outputs its value as compression information and then sets its value to zero when the identification signal indicates that the packet is the effective packet; and recording means which records the compression information output from the counting means and the effective packets in the recording medium; the recording means recording either the discarded packet or the ineffective packet into which the discarded packet has been converted, as the effective packet, when the value of the counting means reaches a predetermined value; and the reproducing apparatus comprises: packet restoring means which reads the compression information indicating the number of discarded packets and the effective packets from the recording medium, generates ineffective packets as many as the discarded packets, and outputs the ineffective packets and the effective packets.

[0035] According to a sixteenth aspect of the present invention, a recording apparatus for processing input data and recording the processed data in a recording medium, comprises: identifying means which receives a fixed clock and an MPEG2 transport stream as input data comprising plural packets having identifiers which is synchronized with the fixed clock as inputs, identifies packets to be discarded and effective packets according to the identifiers, and outputs the effective packets and identification signals each according to a packet identifier of either the packet to be discarded or the effective packet; counting means which increases its value by one when the identification signal indicates that the packet is the packet to be discarded, and outputs its value as compression information and then sets its value to zero when the identification signal indicates that the packet is the effective packet; and recording means which records the compression information output from the counting means and the effective packets in the recording medium.

[0036] According to a seventeenth aspect of the present invention, in the recording apparatus of the sixteenth aspect, the recording means of the recording apparatus inserts the compression information for replacing a continuity counter of an effective packet positioned immediately after the compression information.

[0037] According to an eighteenth aspect of the present invention, a recording apparatus for processing input data and recording the processed data in a recording medium, comprises: identifying means which receives a fixed clock and input data comprising plural packets having identifiers which is synchronized with the fixed clock as inputs, identifies packets to be discarded and effective packets according to the identifiers, and outputs the effective packets and identification signals each indicating that a packet is either the packet to be discarded or the effective packet; counting means which increases its value by one when the identification signal indicates that the packet is the packet to be discarded, and outputs its value as compression information and then sets its value to zero when the identification signal indicates that the packet is the effective packet; and recording means which records the compression information output from the counting means and the effective packets in the recording medium; the recording means recording either the discarded packet or the ineffective packet into which the discarded packet has been converted as the effective packet, when the value of the counting means reaches a predetermined value.

BRIEF DESCRIPTION OF THE DRAWINGS:

[0038]

Figure 1 is a diagram showing a construction of a transmitting system according to a first embodiment of the present invention.

Figure 2 is a diagram for explaining operation of the transmitting system of the first embodiment.

Figure 3 is a diagram showing a TS according to MPEG2 as input data of the first embodiment.

Figure 4 is a flow chart showing a process for compressing packets performed by a transmitting apparatus according to the first embodiment of the present invention.

Figure 5 is a flowchart showing a process for restoring packets performed by a receiving apparatus of the first embodiment.

Figure 6 is a diagram showing a receiving apparatus according to a second embodiment of the present invention.

Figure 7 is a diagram showing a recording and reproducing apparatus according to a third embodiment of the present invention.

Figure 8 is a diagram showing a prior art transmitting system.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS:

[0039] Now, a description will be given of preferred embodiments of the present invention with reference to figures 1 through 5.

[0040] Initially, input data to be processed will be discussed.

[0041] Assume that the input data of the present invention comprises a set of packets which are fixed in length and is a stream synchronized with a clock. By way of example, the MPEG2 TS described in the prior art example will be used herein.

Embodiment 1.

[0042] Figure 1 shows a construction of a transmitting system of the first embodiment. In figure 1, reference numerals 11, 12,and 13 designate a transmitting appa-

ratus, a receiving apparatus, and a transmission line, respectively. The transmitting apparatus 11 comprises packet compressing means 14 and transmitting means 111. The packet compressing means 14 comprises identifying means 141, selecting means 142, a transmitting counter 143, and means for multiplexing compression information (multiplexing means) 144. The receiving apparatus 12 comprises packet restoring means 15, receiving means 121, storage means 122, and an adaptive clock generating device 123. The packet restoring means 15 comprises separating means 151, ineffective (null) packet generating means 152, and multiplexing means 153. Hereinafter, a description will be given of operation of the first embodiment with reference to figure 1.

[0043] First, operation of the transmitting apparatus 11 will be described.

[0044] The transmitting apparatus 11 receives an input clock, the MPEG2 TS synchronized with the input clock as input data, and select information as inputs. The select information is used for sorting out TS packets and is composed of one or a plurality of PIDs. According to the select information, the TS packets contained in the input data is separated into effective packets and packets to-be-discarded. The select information may be a set of PIDs indicating effective packets or a set of PIDs indicating the packets to-be-discarded, and any information will do so long as it can sort out the TS packets. In addition, if it is predetermined that the ineffective (null) packets are always discarded according to fixed PIDs, then the select information may be dispensed with. Besides, a part or all of the select information may be stored in the transmitting apparatus 11 as predetermined (fixed) values. Moreover, the transmitting apparatus 11 may have a table showing correspondences between program numbers and PIDs. In this case, the user specifies a program number, which is converted into the corresponding PID by the transmitting apparatus, and used as the select information.

[0045] In the packet compressing means 14, the identifying means 141 identifies the effective packets and the packets to-be-discarded according to the select information. When the input packet is the effective packet, the identifying means 141 outputs an identification signal indicating that it is the effective packet. On the other hand, when the input packet is the packet to-be-discarded and a counter's value is not smaller than a predetermined value, the identifying means 141 outputs an identification signal indicating that it is the packet to-be-discarded, whereas when the counter's value is larger than the predetermined value, the identifying means 141 outputs an identification signal indicating that it is the effective packet.

[0046] The selecting means 142 receives the input clock, the input data, and the identification signals, and outputs the effective packets according to the identification signals. At this time, the packets to-be-discarded are discarded. The transmitting counter 143 receives the identification signal as an input. When the identification signal indicates the "packet to-be-discarded", the counter 143 increases its value by one, and when the identification signal indicates the "effective packet", the counter 143 outputs its value at that point of time as compression information and then sets its value to "0". In other words, the transmitting counter 143 outputs the "number" of continuously discarded packets between the effective packets.

[0047] When the multiplexing means 144 receives the effective packet (packets) and the compression information as inputs, it multiplexes these, and outputs the resulting compressed data. In this case, the multiplexing means 144 multiplexes the effective packet (packets) and compression information, for example, by adding the compression information before the effective packet (packets), adding the compression information after the effective packet (packets), or placing the compression information between the effective packets. When the compression information is "0", that is, there is no discarded packets between the effective packets, compression information indicating "0" may be transmitted, or the compression information need not be transmitted. The transmitting method is not limited to these, and any method may be employed so long as positions of the effective packets and the compression information are recognized.

[0048] The data length of the compression information is arbitrary. If it is 1 byte, then it can represent 255 continuously discarded packets. In this case, the data length of the compression information is the maximum value of values which the counter 143 might take. When the data length of the compression information is variable, or the data length of the compression information is larger than the number of continuously discarded packets that might be expected, the identifying means 141 need not receive the counter's value, but must output the identification signal indicating whether the input packet is the effective packet or the packet to-be-discarded.

[0049] The packet compressing means 14 thus discards the packets to-be discarded, and packetizes the compression information indicating the number of the discarded packets and the effective packet (packets) subsequent to the compression information, to generate compressed data (a packet). Other constructions of the packet compressing means 14 may be employed provided that it performs such operation.

[0050] The compressed data is output from the packet compressing means 14 and input to the transmitting means 111, which transmits the compressed data through the transmission line 13. As the transmission line 13, an ATM transmission line or an IEEE1394 transmission line may be used. The transmission line 13 may be constructed in different ways so long as it delivers packetized digital data.

[0051] Subsequently, a description will be given of operation of the receiving apparatus 12.

[0052] The receiving means 121 receives the compressed data on the transmission line 13, and sends it to the packet restoring means 15.

[0053] In the packet restoring means 15, the separating means 151 separates the compressed data into the compression information and the effective packet (packets), and then outputs them separately. Then, the ineffective packet generating means 152 outputs ineffective packets which are as many as the discarded packets of the number indicated by the input compression information. In case of the MPEG2 TS, the ineffective packets are packets whose PIDs indicate 0x1fff. The multiplexing means 153 receives the effective packet (packets) or ineffective packet (packets) as inputs. When there are ineffective packets, the multiplexing means 153 outputs the ineffective (packet) packets and then outputs the effective packet (packets). On the other hand, when there are no ineffective packets, the multiplexing means 153 outputs the effective packet (packets).

[0054] The packet restoring means 15 thus receives the compressed data including the compression information and the effective packets as inputs and then outputs ineffective packets of the number indicated by the compression information and the effective packets. In this case, the effective packet positioned after the compression information is output subsequently to the ineffective packets to-be-restored according to the compression information. The construction of the packet restoring means 15 is not limited to that shown in figure 1, and other constructions may be employed provided that it performs such operation.

[0055] The storage means 122 stores the ineffective packets and the effective packets output from the packet restoring means 15, and outputs the stored packets as output data in the order in which they are input. At this time, the storage means 122 outputs the output data in synchronization with the output clock. The storage means 122 also outputs information indicating data amount stored therein. The adaptive clock generating device 123 adjusts the output clock so that the input data amount is set to the predetermined value. To be specific, when the data amount is larger than the predetermined value, the generating device 123 makes the speed of the output clock higher, while when the data amount is smaller than the predetermined value, the generating device 123 makes the speed lower. Other constructions of the generating device 123 may be employed. For instance, the generating device 123 is implemented by a PLL which operates at a frequency of the input clock. Besides, the generating device 123 may use a clock resource that makes clocks at a rate higher than the input clock of the transmitting apparatus 11, and reduce clocks to be output from the clock resource according to the data amount.

[0056] Figure 2 shows the outline of the processing performed by the transmitting system of the first embodiment. In figure 2, reference numeral 21 designates the input data, 22 designates compressed data, 211, 221, and 231 designate the effective packets, 212 designates packets to-be-discarded, 222 designates the compression information, and 232 designates the ineffective packets. Hereinafter, a description will be given of effects of the present invention with reference to figure 2.

[0057] The transmitting apparatus 11 creates the compressed data 22 from the input data 21. The identifying means 141 identifies the effective packets 211 and the packets to-be-discarded 212. The packet compressing means 14 discards the packets 212 to generate the compressed data 22. The compressed data is composed of the effective packet (packets) 221 and the compression information 222. The effective packets 221 are effective packets 211 of the input data, and the compression information 222 indicates the number of the packets 212 discarded immediately before the effective packet (packets) 221.

[0058] The receiving apparatus 12 is adapted to convert the compressed data 22 to the restored data 23. To be specific, the ineffective packets 232 indicated by the compression information 222 are generated, and inserted immediately before the corresponding effective packet (packets) 221. The received effective packets 221 are the effective packets 231. As a result, these ineffective packets 232 and the effective packets 231 are output.

[0059] Thus, in accordance with the transmitting system of the first embodiment, the transmitting apparatus 11 discards the packets to-be-discarded and transmits the compression information indicating the number of the continuously discarded packets. Therefore, it is possible to reduce the amount of data and thereby improve transmission efficiency in the use of the transmission line.

[0060] In the transmitting apparatus 11 of the transmitting system of the first embodiment, when the value of the counter 143 is larger than the predetermined value, the identifying means 141 outputs the identification signal indicating the "effective packet" regardless of whether or not the packet of the input data is effective or ineffective. The predetermined value is set to the size of the transmission counter 143 to thereby prevent it from overflowing.

[0061] The receiving apparatus 12 of the transmitting system of the first embodiment is capable of inserting the ineffective packets which are as many as the discarded packets into the same spots where the discarded packets were placed, according to the compression information. Hence, the data output from the receiving apparatus is equal in amount to the data input to the transmitting apparatus. In addition, the effective packets of the input and output data are disposed in the same position. Therefore, even if some variance of delay might occur at transmission, the adaptive clock generating device 123 can reproduce the clock with ease. The time intervals at which the effective packets arrive at a decoder are identical to those of the

effective packets in the input data to the transmitting apparatus.

[0062] Thus, in accordance with the transmitting system, the transmitting apparatus, and the receiving apparatus of the first embodiment, when transferring data comprising plural packets such as the MPEG2 TS, it is possible to reduce the amount of data, reproduce the transmission clock of the data, and maintain time intervals of required packets contained in the data.

[0063] The construction of the packet compressing means 14 is not limited to that shown in figure 1 as mentioned previously. Another example of implementation of the packet compressing means 14 will be described following a flowchart in figure 4.

[0064] Turning now to figure 4, in STEP 0, the counter's value is set to "0". The counter herein is a variable for software processing by a CPU, or is a counter device for hardware. In STEP 1, the packet is input. In STEP 2, the type of the packet is identified according to the select information. In STEP 6, when the packet is a packet to-be-discarded, it is decided whether or not the counter's value is the predetermined value. The predetermined value is the maximum value which the counter might take. When decided that the counter's value is less than the predetermined value, in STEP 7, the counter's value is increased by "1". When decided that the counter's value is the predetermined value, in STEP 8, the counter's value is output as the compression information. In STEP 9, the counter's value is set to "0". In STEP 10, the ineffective packets or the effective packets and the compression information are output. When decided that the packet is the effective packet in STEP 2, in STEP 3, the counter's value is output as the compression information. In STEP 4, the counter's value is set to "0". In STEP 5, the effective packet (packets) and the compression information are output. The packet compressing means 15 outputs the effective packet and the compression information in the same manner as the transmitting means 114.

[0065] The packet compressing means 14 may be constituted by hardware shown in figure 1, may be hardware or may perform computer processing by software provided that it operates following the procedure shown in figure 4. The packet compressing means 14 may be constructed in different ways so long as it receives the input data composed of plural packets having PIDs, identifies the effective packets and the packets to-be-discarded according to the PIDs, and outputs the compression information indicating the number of the discarded packets and the effective packets.

[0066] The construction of the packet restoring means 15 is not limited to that shown in figure 1 as mentioned previously. Another example of implementation of the packet restoring means 15 will be described following a flowchart in figure 5.

[0067] Turning now to figure 5, in STEP 11, the compressed data is input to the packet restoring means 15. In STEP 12, the compression information and the effective packet (packets) are identified. When the compression information is identified in STEP 12, in STEP 13, the ineffective packet (packets) as many as the number indicated by the compression information are output. When the effective packet (packets) is identified in STEP 12, the effective packet (packets) is output in STEP 14.

[0068] The packet restoring means 15 may be constituted by hardware shown in figure 1, may be hardware, or may perform computer processing provided that it operates following the procedure shown in figure 5. The packet restoring means 15 may be constructed in different ways so long as it receives the effective packet and the compression information as inputs, and generates and outputs the ineffective packets as many as the discarded packets.

[0069] The input data to be processed is not limited to MPEG TS synchronized with the fixed clock. The present invention is applicable to any stream composed of a set of packets which are fixed in length and can be identified according to the PIDs.

[0070] The input data is not limited to the data composed of TS packets (188 byte). In digital broadcasting, a 16-byte error correction code is added to each TS packet of 188 byte in some cases, or a tuner processes the error correction code, and then 16-byte dummy data (insignificant data) is added to the 188-byte packet in other cases. To process such input data, the transmitting apparatus 11 removes the 16-byte error correction code or the dummy data, which results in the 188-byte effective packet. Then, the data restoring means adds the 16-byte dummy data to the 188-byte effective or ineffective packet, to generate 204-byte data. In accordance with this, data can be further compressed. Needless to say, the 204-byte packet may be assumed to be the effective packet. In a case where 188-byte packets and 204-byte packets coexist, flags each indicating "188 byte" or "204 byte" may be added to the respective packets. In accordance with this, the same apparatus can process both of these data.

[0071] The select information is not limited to the set of PIDs indicating the effective packets. For instance, a set of PIDs indicating packets to-be-discarded may be used. In addition, it is not always necessary to input the select information to the transmitting apparatus. If fixed selecting conditions are used, all or a part of the select information may be recorded in the transmitting apparatus 11 as fixed values. In addition, packets including PSI (Program Specific Information) may be unconditionally considered as effective packets. In addition, if it is predetermined that ineffective (null) packets are always discarded according to fixed PIDs, the selecting information may be dispensed with. Moreover, the transmitting apparatus 11 may have a table showing correspondences between program numbers and PIDs. In this case, the user specifies a program number, which is converted into the corresponding PID by the transmitting apparatus, and used as the select informa-

tion. Other select information may be used so long as the TS packets can be sorted out according to the same.

[0072] As for the method for transmitting the compression information, instead of using the method for adding the compression information before the TS packet, a method for replacing reproducible information in the TS packet may be employed. For instance, the CC may be replaced by the compression information, which is taken out by the receiving apparatus, and then the CC is reproduced. The CC is 4 bits and can represent 16 continuously discarded packets. When replacing the CC, a duplicated packet is deleted as packets to-be-discarded. In addition, assuming that the lower 1 bit is not replaced, in a case where continuous TS packets have the same PID and their CCs' lower 1 bits have the same value, it is decided that that these TS packets contain the same CC when it is reproduced by the receiving apparatus. Further, in a case where transmission is performed on a packet basis on the transmission line and the receiving apparatus need not identify the head of the TS packet according to the Sync Byte, the Sync Byte may be replaced by the compression information. These methods make it possible that the data length is not made larger than the length of the TS packet, and are applicable to arbitrary transmission lines.

[0073] The operation of the adaptive clock generating device 123 is not limited to keeping the amount of data in the storage means 122 constant. The generating device 123 may operate in such a way that it keeps the amount of data stored in the storage means 122 when the effective packet is input thereto. The amount of data in the storage means 122 is reduced at a constant rate according to the output clock, and increased when one of the packets of the compressed data is input. Therefore, by using the amount of data at the input of one packet as a criterion, it is possible to output the clock more correctly.

Embodiment 2.

[0074] A description will now be given of a receiving apparatus in a transmitting system according to a second embodiment of the present invention with reference to figure 6.

[0075] Turning now to figure 6, reference numerals 611, 612, 613, 614, 615, 64, 641, 642, 643, 644, and 645 designate receiving means, storage means, separating means, means for computing data amount (computing means), packet restoring means, packet separating means, a receiving counter, control means, means for generating ineffective packets (generating means), and multiplexing means, respectively.

[0076] The receiving apparatus of this embodiment has replaced the receiving apparatus 12 of the first embodiment, and is adapted to receive the compressed data transmitted from the transmitting means 11.

[0077] The receiving means 611 receives the compressed data on the transmission line, which is then stored in the storage means 612. The storage means 612, in response to a read request from the control means 643, outputs the stored data on a first-in, first-out basis. The storage means 612 also outputs "data amount" indicating the amount of data currently stored. The data amount may be the amount of stored data or may be a flag indicating the presence/absence of one or more packets of the compressed data.

[0078] The packet restoring means 64 reads one of the compression information or the effective packet (packets) from the storage means 612, and then processes them. The packet separating means 641 separates the input compressed data into the compression information and the effective packet (packets), and outputs them.

[0079] The compression information is input to the receiving counter 642. Receiving the compression information, the counter 642 adds its value to the number of the continuously discarded packets of the number indicated by the compression information. When a subtraction instruction is input, the counter 642 decreases its value by one. Assume that the counter 642 can take negative values.

[0080] The control means 643 receives the output clock, the data amount, the counter's value, and the effective packet (packets) as inputs. Instead of the effective packet (packets), a flag indicating the presence/absence of the effective packets may be input. The control means 643 operates on a packet-time basis indicated by the output clock.

[0081] The control means 643, when the counter's value is "0" and the data amount indicates there is one or more compressed data, outputs a read request to the storage means 612. When the counter's value is not smaller than "1" as a result of reading, the control means 643 outputs a select signal indicating the "ineffective packet" to the multiplexing means 645, outputs the output request to the ineffective packet generating means 644, and outputs the subtraction instruction to the counter 642 for directing it to decrease its value by one. When the separating means 641 outputs the effective packet as a result of reading, the control means 643 outputs the select signal indicating the "effective packet" to the multiplexing means 645.

[0082] The control means 643, when the counter's value is "0", and the data amount indicating that there is no compressed data, outputs a select signal indicating the "ineffective packet" to the multiplexing means 645, outputs the output request to the ineffective packet generating means 644, and outputs the subtraction instruction to the counter 642 for directing it to decrease its value by one.

[0083] The control means 643, when the counter's value is not smaller than "1", outputs a select signal indicating the "ineffective packet" to the multiplexing means 645, outputs the output request to the ineffective packet generating means 644, and outputs the subtraction

instruction to the counter 642 for directing it to decrease its value by one.

[0084] Receiving the output request, the ineffective packet generating means 644 outputs the ineffective packet. The multiplexing means 645 outputs the ineffective or effective packet according to the select signal.

[0085] When the separating means 613 receives the compressed data input from the receiving means, it outputs the compression information and the effective packet (packets) to the computing means 614. The computing means 614, when the compression information is input thereto, increases its value by ((the number of the continuously discarded packets indicated by the compression information) × packet length), and when the effective packet is input thereto, it increases its value by the packet length. The computing means 614 also decreases the value according to the output clock. The adaptive clock generating device 615 outputs the clock so that the amount of data in the computing means 614 is kept constant. To be specific, when the counter's value is larger than the predetermined value, the generating device 615 makes the speed of the output clock higher, while when the counter's value is smaller than the predetermined value, it makes the speed lower. If the generating device 615 controls the output clock so that the amount of data increased as a result of the input of the effective packet to the computing means 614 is kept constant, then the clock can be reproduced more correctly.

[0086] Thus, in accordance with the second embodiment, since the compression information before generating the ineffective packets is stored in the storage, the same effects provided by the transmitting system of the first embodiment is attained with the storage of a smaller capacity, in contrast with the receiving apparatus of the first embodiment.

[0087] The construction of the computing means 614 is not limited to that of this embodiment. For instance, when one compression information is always present before one effective packet, the computing means 614 may receives only the compression information as an input, and may increase its value by ((the numbers of the continuously discarded packets indicated by the compression information + 1) × packet length). This realizes a simpler construction.

[0088] In addition, the construction of the packet restoring means 64 is not limited to that shown in figure 6. The other construction may be employed so long as the packet restoring means 64 reads the effective packets and the compression information indicating the number of the discarded packets from the storage means, outputs the effective packets and the ineffective packets of the number indicated by the compression information, and outputs the ineffective packets when there is no data in the storage means and outputs ((the ineffective packets of the number indicated by the following compression information) minus (the number of these output ineffective packets)).

Embodiment 3.

[0089] Hereinafter, a description will be given of a recording and reproducing apparatus according to a third embodiment of the present invention with reference to figure 7.

[0090] In figure 7, reference numerals 71, 72, and 73 designate a recording apparatus, a reproducing apparatus, and a recording medium, respectively. The recording apparatus 71 comprises recording means 711, and packet compressing means 74. The reproducing apparatus 72 comprises reproducing means 721, clock generating means 722, and packet restoring means 75. The packet restoring means 75 comprises packet separating means 751, a receiving counter 752, control means 753, ineffective packet generating means 754, and multiplexing means 755.

[0091] Operation of the recording apparatus 71 will be described.

[0092] The operation of the packet compressing means 74 of the recording apparatus 71 is identical to that of the packet compressing means 14 of the transmitting apparatus of the first embodiment, and therefore, will not be discussed herein. The compressed data output from the packet compressing means 74 is recorded in the recording medium 73 by the recording means 711.

[0093] As the recording medium, an optical disc, an optical magnetic disc, a hard disc, a memory, a magnetic tape, and so forth are available.

[0094] The operation of the reproducing apparatus 72 will be described.

[0095] The reproducing means 721, in response to a read request from the packet restoring means 75, reads data from the recording medium 73.

[0096] The construction of the packet restoring means 75 is almost identical to that of the packet restoring means 64 of the second embodiment, and difference between them is that the packet restoring means 64 outputs ineffective (packet) packets when there is no compressed data but the packet restoring means 75 will not output data when there is no compressed data. The difference will be described below. The operation of each means which will not be described herein is identical to that of each means of the packet restoring means 64 of the second embodiment.

[0097] While the receiving counter 642 of the second embodiment may take negative values, the receiving counter 752 of the third embodiment takes only positive values. While the control means 643 of the second embodiment receives the data amount and performs control according to the data amount, the control means 753 does not perform control according to the data amount. The control means 753 receives the output clock, the counter's value, and the effective packet (packets) as inputs, and operates on a packet-time basis indicated by the output clock. When the counter's value is "0", the control means 753 outputs a read

request to the reproducing means 721. When the counter's value is "1" or more, the control means 753 outputs a select signal indicating the "ineffective packet", outputs an output request to the ineffective packet generating mans 754, and outputs a subtraction instruction to the receiving counter 752 for directing it to decrease its value by one. When the separating means 751 outputs the effective packet to the multiplexing means 755, the control means 753 outputs the select signal indicating the "effective packet" to the multiplexing means 755.

[0098] On the other hand, when the counter's value is "1" or more, the control means 753 outputs the select signal indicating the "ineffective packet" to the multiplexing means 755, outputs the output request to the ineffective packet generating means 754, and outputs the subtraction instruction to the receiving counter 752 for directing it to decrease its value by one.

[0099] The clock generating means 722 outputs a clock at the speed almost as high as that of a clock input to the recording apparatus 71.

[0100] As should be appreciated from the foregoing description, when recording data comprising plural packets such as the MPEG TS input in synchronization with the fixed clock, it is possible to reduce the recording capacity. Besides, since the data length of the input data is identical to that of the output data and the effective packets are present in the same spots in these data, correctly decoded data can be reproduced.

[0101] The construction of the packet restoring means 75 of the third embodiment is not limited to that shown in figure 7. The other constructions may be employed so long as the packet restoring means 75 reads the effective packets and the compression information indicating the number of the discarded packets from the storage, and outputs the ineffective packets of the number indicated by the compression information and the effective packets.

Claims

1. A transmitting system which comprises a transmission line, a transmitting apparatus connected to the transmission line, and a receiving apparatus connected to the transmission line, and transmits data between the transmitting apparatus and the receiving apparatus, wherein

   the transmitting apparatus comprises packet compressing means which receives input data comprising plural packets having identifiers as an input, identifies packets to be discarded and effective packets according to the identifiers, and outputs compression information indicating the number of continuously discarded packets and the effective packets to the transmission line, and
   the receiving apparatus comprises packet restoring means which receives the compression information and the effective packets which have been output from the transmitting apparatus, generates ineffective packets which are as many as the discarded packets, and outputs the ineffective packets and the effective packets.

2. The transmitting system of Claim 1 wherein

   the transmitting apparatus further comprises:
   identifying means which receives a fixed clock and the input data synchronized with the fixed clock as inputs, identifies the packets to be discarded and the effective packets according to the identifiers, and outputs identification signals each indicating that a packet is either the effective packet or the packet to be discarded; and
   counting means for counting the number of continuously discarded packets from the identification signals.

3. The transmitting system of Claim 2 wherein

   the input data to the transmitting apparatus is a transport stream according to MPEG2, and
   the identification signals each indicates that the packet is either the packet to be discarded or the effective packet according to the corresponding packet identifier.

4. The transmitting system of Claim 3 wherein

   the output means of the transmitting apparatus inserts the compression information for replacing a continuity counter of an effective packet positioned immediately after the compression information, and
   the packet restoring means of the receiving apparatus uses data in the continuity counter as the number of the continuously discarded packets, and replaces the continuity counter with the number which increases one by one among the packets of the same packet identifier.

5. The transmitting system of Claim 2 wherein

   the transmitting apparatus, when the value of the counting means reaches a predetermined value, outputs either the packet to be discarded or the ineffective packet into which the discarded packet has been converted, as the effective packet.

6. The transmitting system of Claim 1 wherein

   the receiving apparatus further comprises:

a storage for storing the ineffective packets and the effective packets as data and outputting the packets in synchronization with a clock in the order in which the packets are input; and

an adaptive clock generating device for outputting the clock so that the amount of the data stored in the storage is kept constant.

7. The transmitting system of Claim 2 wherein

the receiving apparatus further comprises:
a storage for storing the ineffective packets and the effective packets as data and outputting the packets in synchronization with a clock in the order in which the packets are input; and
an adaptive clock generating device for outputting the clock so that the amount of the data stored in the storage is kept constant.

8. The transmitting system of Claim 6 wherein

the adaptive clock generating device outputs the clock so that the amount of the data stored in the storage when one effective packet is input thereto is kept constant.

9. The transmitting system of Claim 7 wherein

the adaptive clock generating device outputs the clock so that the amount of the data stored in the storage when one effective packet is input thereto is kept constant.

10. The transmitting system of Claim 1 wherein

the receiving apparatus further comprises:
a storage for storing the effective packets and the compression information as data and outputting the data in the order as entered;
packet restoring means for reading the data from the storage, outputting the ineffective packets when there is no data in the storage, and outputting the ineffective packets which are as many as the discarded packets of the number indicated by the compression information and the effective packets when there is data in the storage, the ineffective packets and the effective packets being output in synchronization with the clock;
a counter for increasing its value by (the number of the discarded packets indicated by the compression information) × (packet length) when the compression information is input thereto, increasing its value by the packet length of the effective packet when the effective packet is input thereto, and decreasing its value by one when the clock is input thereto; and
an adaptive clock generating device for outputting the clock so that the value of the counter is kept constant.

11. The transmitting system of Claim 2 wherein

the receiving apparatus further comprises:
a storage for storing the effective packets and the compression information as data and outputting the data in the order as entered;
packet restoring means for reading the data from the storage, outputting the ineffective packets when there is no data in the storage, and outputting the ineffective packets which are as many as the discarded packets of the number indicated by the compression information and the effective packets when there is data in the storage, the ineffective packets and the effective packets being output in synchronization with the clock;
a counter for increasing its value by (the number of the discarded packets indicated by the compression information) × (packet length) when the compression information is input thereto, increasing its value by the packet length of the effective packet when the effective packet is input thereto, and decreasing its value by one when the clock is input thereto; and
an adaptive clock generating device for outputting the clock so that the value of the counter is kept constant.

12. The transmitting system of Claim 10 wherein

the adaptive clock generating device outputs the clock so that the value of the counter counted when the effective packet is received is kept constant.

13. The transmitting system of Claim 11 wherein

the adaptive clock generating device outputs the clock so that the value of the counter counted when the effective packet is received is kept constant.

14. A transmitting apparatus for processing input data and outputting the processed data to a transmission line, said apparatus comprising:

identifying means which receives a fixed clock and an MPEG2 transport stream as input data comprising plural packets having identifiers as inputs, identifies packets to be discarded and effective packets according to the identifiers, and outputs the effective packets and identification signals each according to a packet identifier of either the packet to be discarded or the effective packet;

counting means for counting the number of continuously discarded packets from the identification signals; and

output means for outputting compression information indicating the number of continuously discarded packets which has been counted by the counting means and the effective packets to the transmission line.

15. The transmitting apparatus of Claim 14 wherein

the output means inserts the compression information for replacing a continuity counter of the effective packet positioned immediately after the compression information.

16. A transmitting apparatus for processing input data and outputting the processed data to a transmission line, said apparatus comprising:

identifying means which receives a fixed clock and the input data comprising plural packets having identifiers which is synchronized with the fixed clock as inputs, identifies the packets to be discarded and the effective packets according to the identifiers, and outputs identification signals each indicating that a packet is either the effective packet or the packet to be discarded;

counting means for counting the number of continuously discarded packets from the identification signals; and

output means for outputting compression information indicating the number of continuously discarded packets which has been counted by the counting means and the effective packets to the transmission line;

the output means outputting either the discarded packet or the ineffective packet into which the discarded packet has been converted, as the effective packet, when the value of the counting means reaches a predetermined value.

17. A recording and reproducing apparatus which comprises a recording apparatus for processing input data and recording the processed data in a recording medium, and a reproducing apparatus for reading the data from the recording medium, wherein

the recording apparatus comprises identifying means which receives a fixed clock and an MPEG2 transport stream as input data comprising plural packets having identifiers which is synchronized with the fixed clock as inputs, identifies packets to be discarded and effective packets according to the identifiers, and outputs the effective packets and identification signals each according to a packet identifier of either the packet to be discarded or the effective packet; counting means which increases its value by one when the identification signal indicates that the packet is the packet to be discarded, and outputs its value as compression information and then sets its value to zero when the identification signal indicates that the packet is the effective packet; and recording means which records the compression information output from the counting means and the effective packets in the recording medium; and

the reproducing apparatus comprises packet restoring means which reads the compression information indicating the number of discarded packets and the effective packets from the recording medium, generates ineffective packets as many as the discarded packets, and outputs the ineffective packets and the effective packets.

18. The recording and reproducing apparatus of Claim 17 wherein the recording means of the recording apparatus inserts the compression information for replacing a continuity counter of an effective packet positioned immediately after the compression information, and

the packet restoring means of the receiving apparatus uses data in the continuity counter as the number of the continuously discarded packets, and replaces the continuity counter with the number which increases one by one among the packets of the same packet identifier.

19. A recording and reproducing apparatus which comprises a recording apparatus for processing input data and recording the processed data in a recording medium, and a reproducing apparatus for reading the data from the recording medium, wherein

the recording apparatus comprises identifying means which receives a fixed clock and input data comprising plural packets having identifiers which is synchronized with the fixed clock as inputs, identifies packets to be discarded and effective packets according to the identifiers, and outputs the effective packets and identification signals each indicating that a packet is either the packet to be discarded or the effective packet; counting means which increases its value by one when the identification signal indicates that the packet is the packet to be discarded, and outputs its value as compression information and then sets its value to zero when the identification signal indicates that the packet is the effective packet; and recording

means which records the compression information output from the counting means and the effective packets in the recording medium;

the recording means recording either the discarded packet or the ineffective packet into which the discarded packet has been converted, as the effective packet, when the value of the counting means reaches a predetermined value; and

the reproducing apparatus comprises packet restoring means which reads the compression information indicating the number of discarded packets and the effective packets from the recording medium, generates ineffective packets as many as the discarded packets, and outputs the ineffective packets and the effective packets.

20. A recording apparatus for processing input data and recording the processed data in a recording medium, said apparatus comprising:

identifying means which receives a fixed clock and an MPEG2 transport stream as input data comprising plural packets having identifiers which is synchronized with the fixed clock as inputs, identifies packets to be discarded and effective packets according to the identifiers, and outputs the effective packets and identification signals each according to a packet identifier of either the packet to be discarded or the effective packet;

counting means which increases its value by one when the identification signal indicates that the packet is the packet to be discarded, and outputs its value as compression information and then sets its value to zero when the identification signal indicates that the packet is the effective packet; and

recording means which records the compression information output from the counting means and the effective packets in the recording medium.

21. The recording apparatus of Claim 20 wherein the recording means of the recording apparatus inserts the compression information for replacing a continuity counter of an effective packet positioned immediately after the compression information.

22. A recording apparatus for processing input data and recording the processed data in a recording medium, said apparatus comprising:

identifying means which receives a fixed clock and input data comprising plural packets having identifiers which is synchronized with the fixed clock as inputs, identifies packets to be discarded and effective packets according to the identifiers, and outputs the effective packets and identification signals each indicating that a packet is either the packet to be discarded or the effective packet;

counting means which increases its value by one when the identification signal indicates that the packet is the packet to be discarded, and outputs its value as compression information and then sets its value to zero when the identification signal indicates that the packet is the effective packet; and

recording means which records the compression information output from the counting means and the effective packets in the recording medium;

the recording means recording either the discarded packet or the ineffective packet into which the discarded packet has been converted as the effective packet, when the value of the counting means reaches a predetermined value.

Fig.1

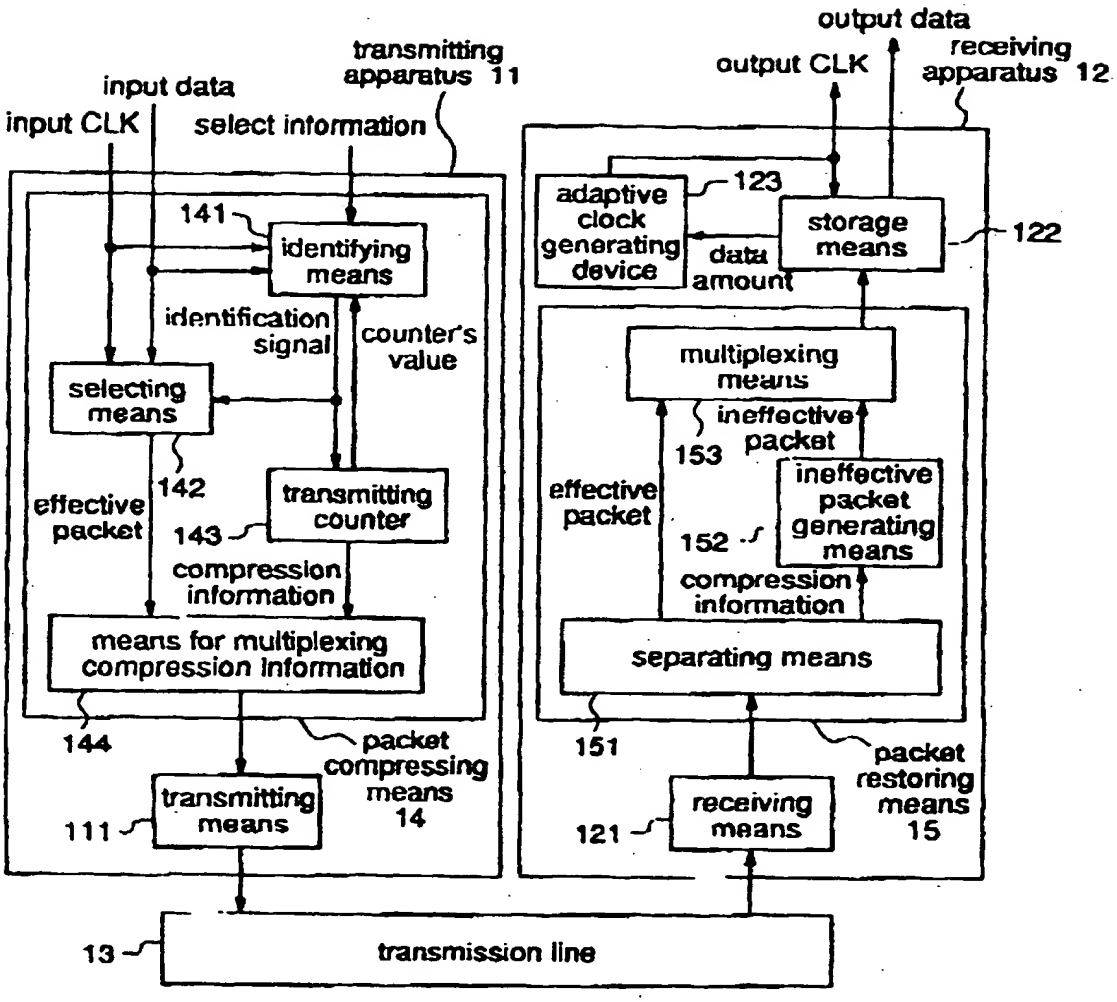

transmitting apparatus 11
input data
input CLK
select information
141
identifying means
identification signal
counter's value
selecting means
142
effective packet
transmitting counter
143
compression information
means for multiplexing compression information
144
packet compressing means 14
transmitting means
111
output data
output CLK
receiving apparatus 12
adaptive clock generating device
123
storage means
122
data amount
multiplexing means
ineffective packet
153
effective packet
ineffective packet generating means
152
compression information
separating means
151
packet restoring means 15
receiving means
121
13
transmission line

Fig.2

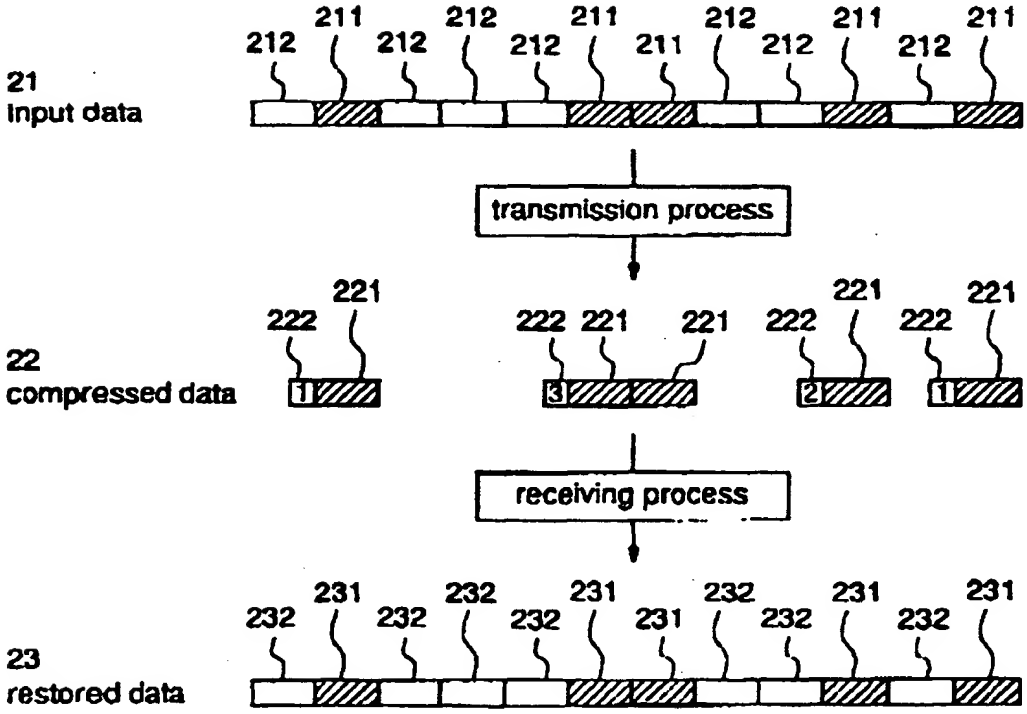

21
Input data
212 211 212 212 212 211 212 211 212 211 212
transmission process
22
compressed data
222 221 222 221 221 222 221 222 221
1 3 2 1
receiving process
23
restored data
232 231 232 232 232 231 232 231 232 231 232

Fig.3 (a)

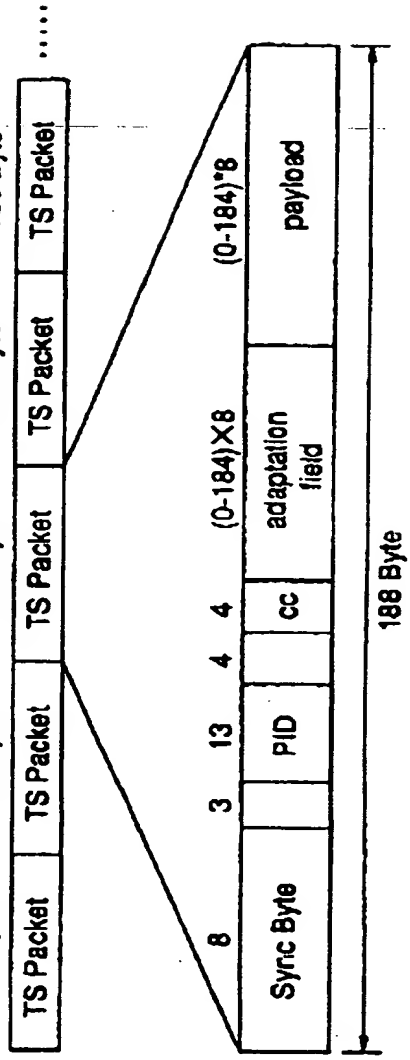

MPEG-TS
188 Byte
TS Packet
188 Byte
TS Packet
188 Byte
TS Packet
188 Byte
TS Packet
.....
8
Sync Byte
3
13
PID
4
4
cc
(0-184)X8
adaptation field
(0-184)*8
payload
188 Byte

Fig.3 (b)

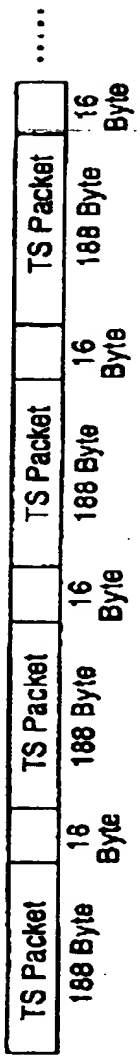

MPEG-TS (204 Byte Mode)
TS Packet
188 Byte
16 Byte
TS Packet
188 Byte
16 Byte
TS Packet
188 Byte
16 Byte
TS Packet
188 Byte
16 Byte
.....

Fig.4

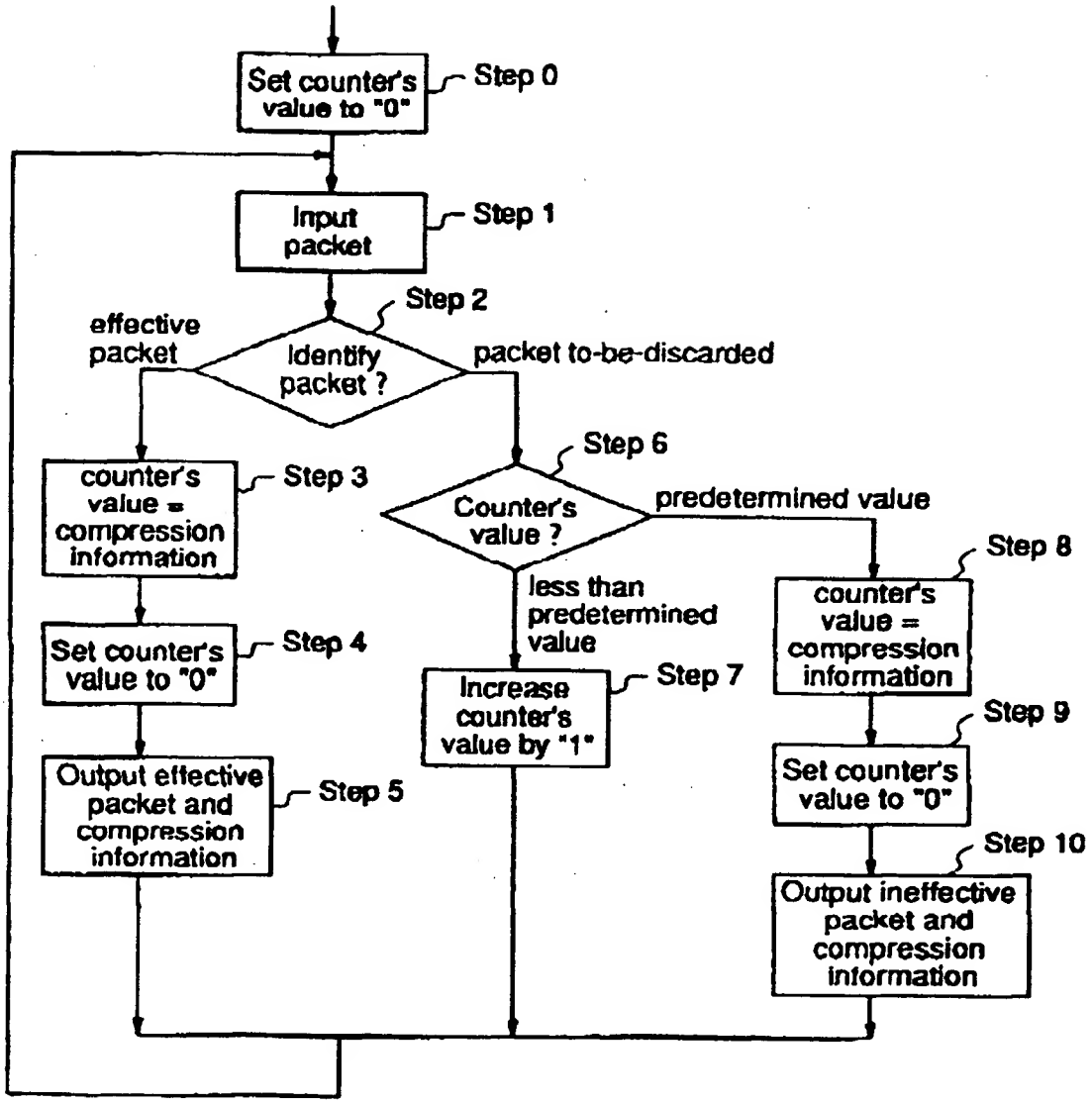

Set counter's value to "0"
Step 0
Input packet
Step 1
Step 2
effective packet
Identify packet ?
packet to-be-discarded
counter's value = compression information
Step 3
Step 6
Counter's value ?
predetermined value
Set counter's value to "0"
Step 4
less than predetermined value
Increase counter's value by "1"
Step 7
counter's value = compression information
Step 8
Output effective packet and compression information
Step 5
Set counter's value to "0"
Step 9
Output ineffective packet and compression information
Step 10

Fig.5

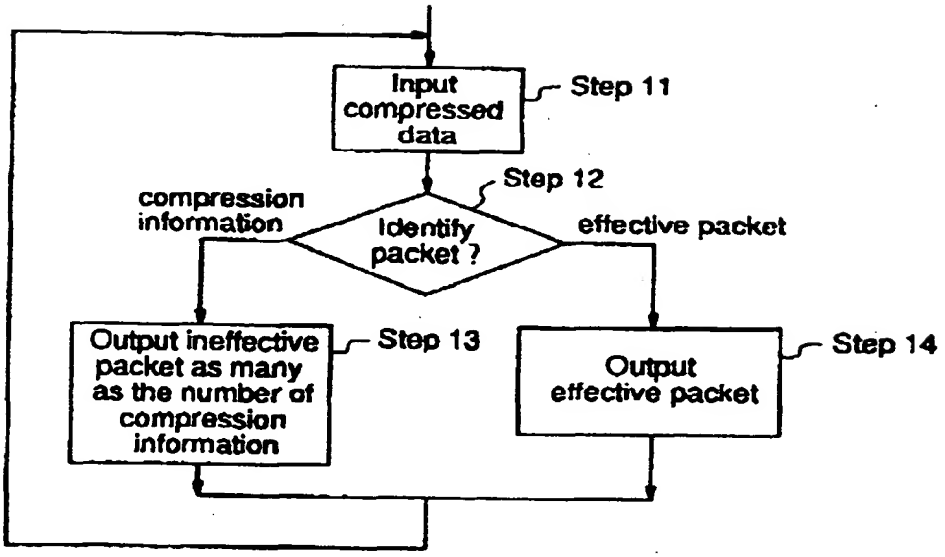

Input compressed data
Step 11
Step 12
compression information
Identify packet ?
effective packet
Output ineffective packet as many as the number of compression information
Step 13
Output effective packet
Step 14

Fig.6

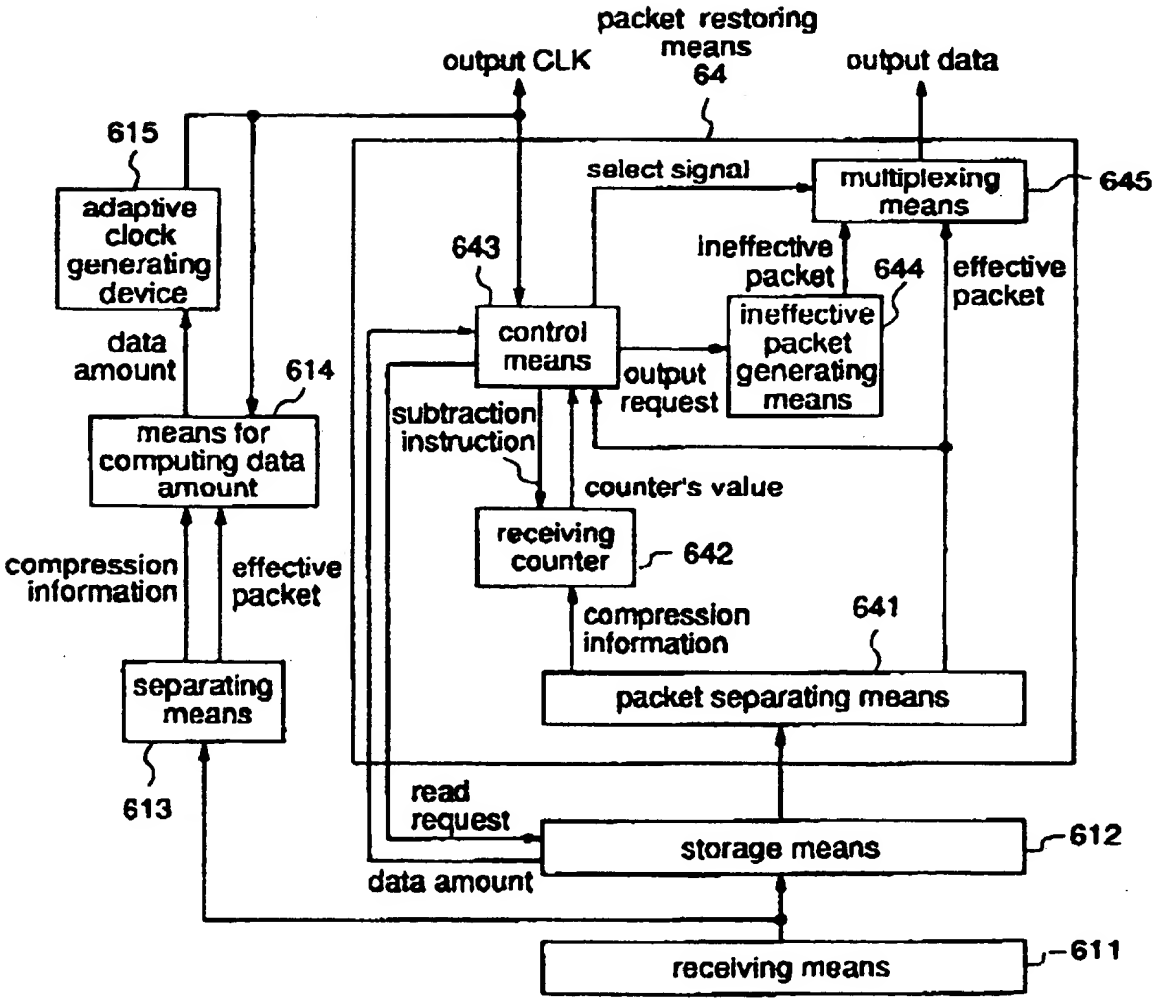

packet restoring means
64
output CLK
output data
615
adaptive clock generating device
data amount
614
means for computing data amount
compression information
effective packet
separating means
613
select signal
multiplexing means
645
643
ineffective packet
644
effective packet
control means
ineffective packet generating means
output request
subtraction instruction
counter's value
receiving counter
642
compression information
641
packet separating means
read request
storage means
612
data amount
receiving means
611

Fig.7

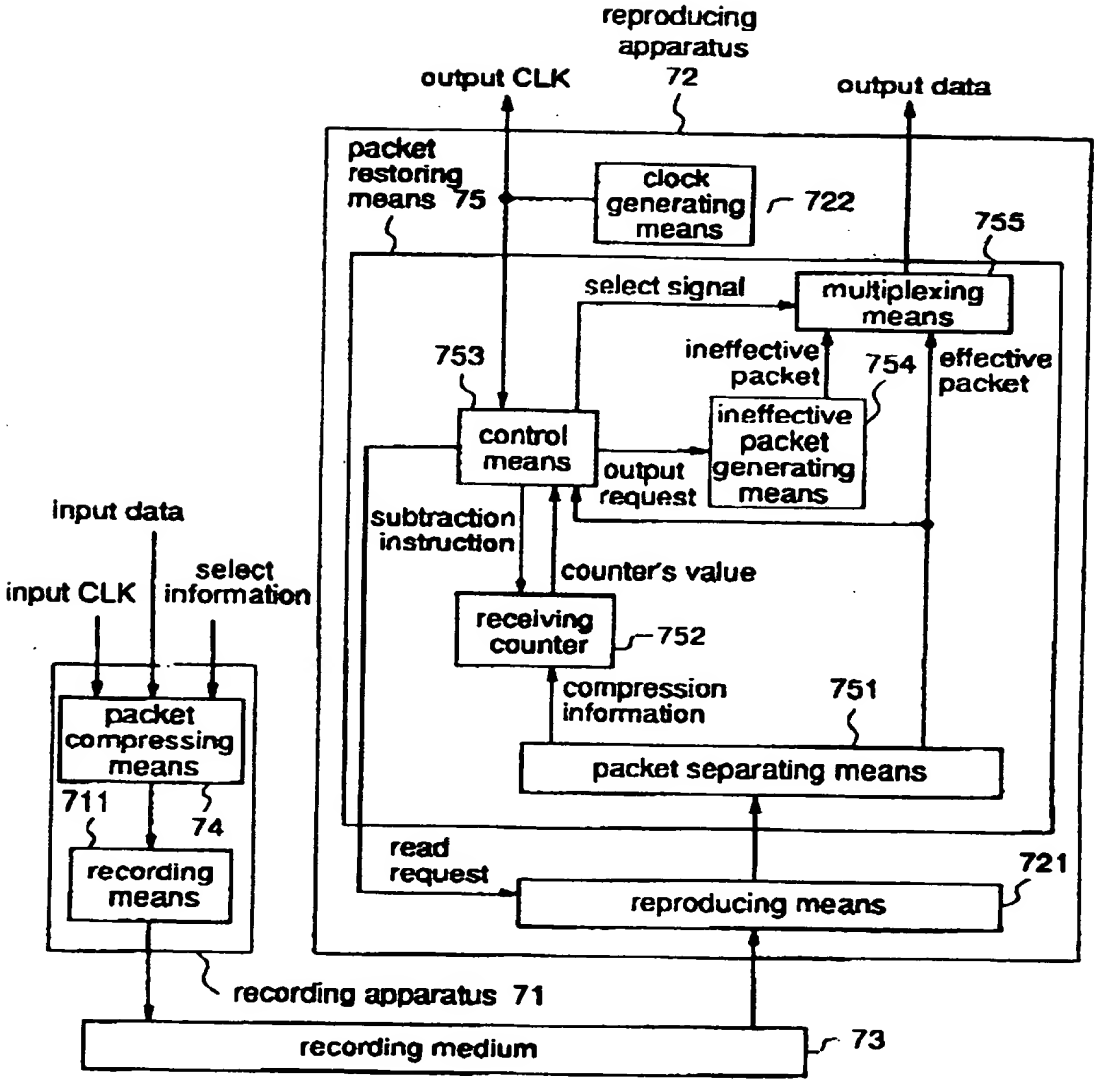
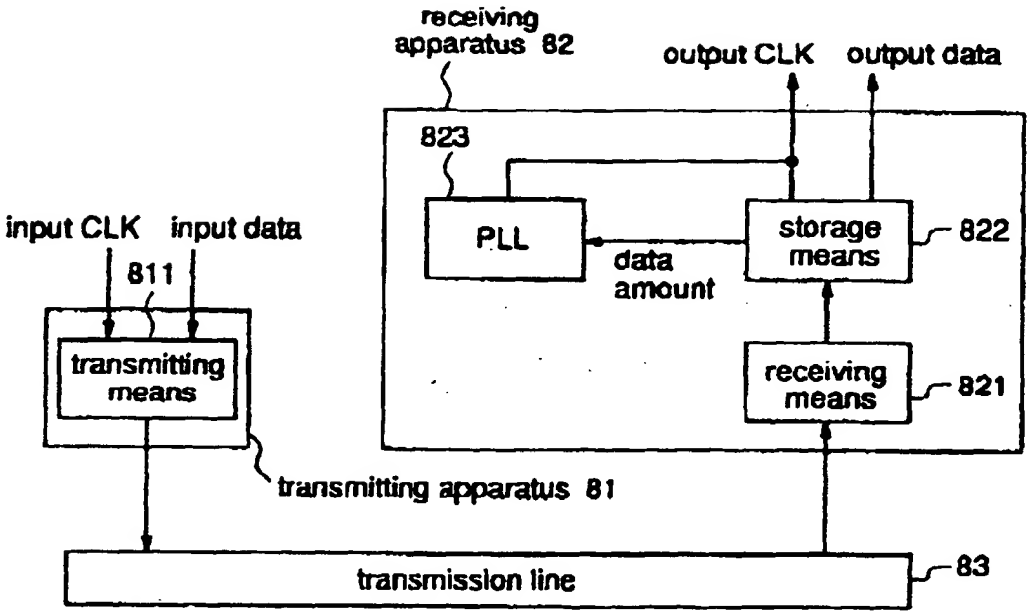

reproducing apparatus 72
output CLK
output data
packet restoring means 75
clock generating means
722
755
select signal
multiplexing means
753
ineffective packet
754
effective packet
control means
ineffective packet generating means
output request
input data
input CLK
select information
subtraction instruction
counter's value
receiving counter
752
compression information
751
packet compressing means
711
74
packet separating means
read request
721
recording means
reproducing means
recording apparatus 71
recording medium
73

Fig.8 Prior Art



European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 99 10 1116

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A	"DESIGN ARCHITECTURE FOR MPEG2 TRANSPORT DEMULTIPLEXOR ASSIST" IBM TECHNICAL DISCLOSURE BULLETIN, vol. 39, no. 4, 1 April 1996, pages 283-286, XP000587499 * the whole document *	1,3,14, 16	H04N7/52 H04L29/06
A	US 5 627 829 A (ALTMAIER PAULETTE R ET AL) 6 May 1997 * abstract * * column 8, line 33 - line 44 *	1,14,16	
A	PATENT ABSTRACTS OF JAPAN vol. 098, no. 005, 30 April 1998 & JP 10 023370 A (SANYO ELECTRIC CO LTD), 23 January 1998 * abstract *	17,20,22	
A	DATABASE WPI Section EI, Week 9912 Derwent Publications Ltd., London, GB; Class T03, AN 99-138423 XP002100983 & JP 11 007724 A (VICTOR CO OF JAPAN) , 12 January 1999 * abstract *	17,20,22	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)
H04N
H04L

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
BERLIN	23 April 1999	Masche, C

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 99 10 1116

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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23-04-1999

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5627829 A	06-05-1997	US 5446736 A	29-08-1995
		AU 7927994 A	01-05-1995
		CA 2168351 A	13-04-1995
		WO 9510150 A	13-04-1995

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

Fig.1

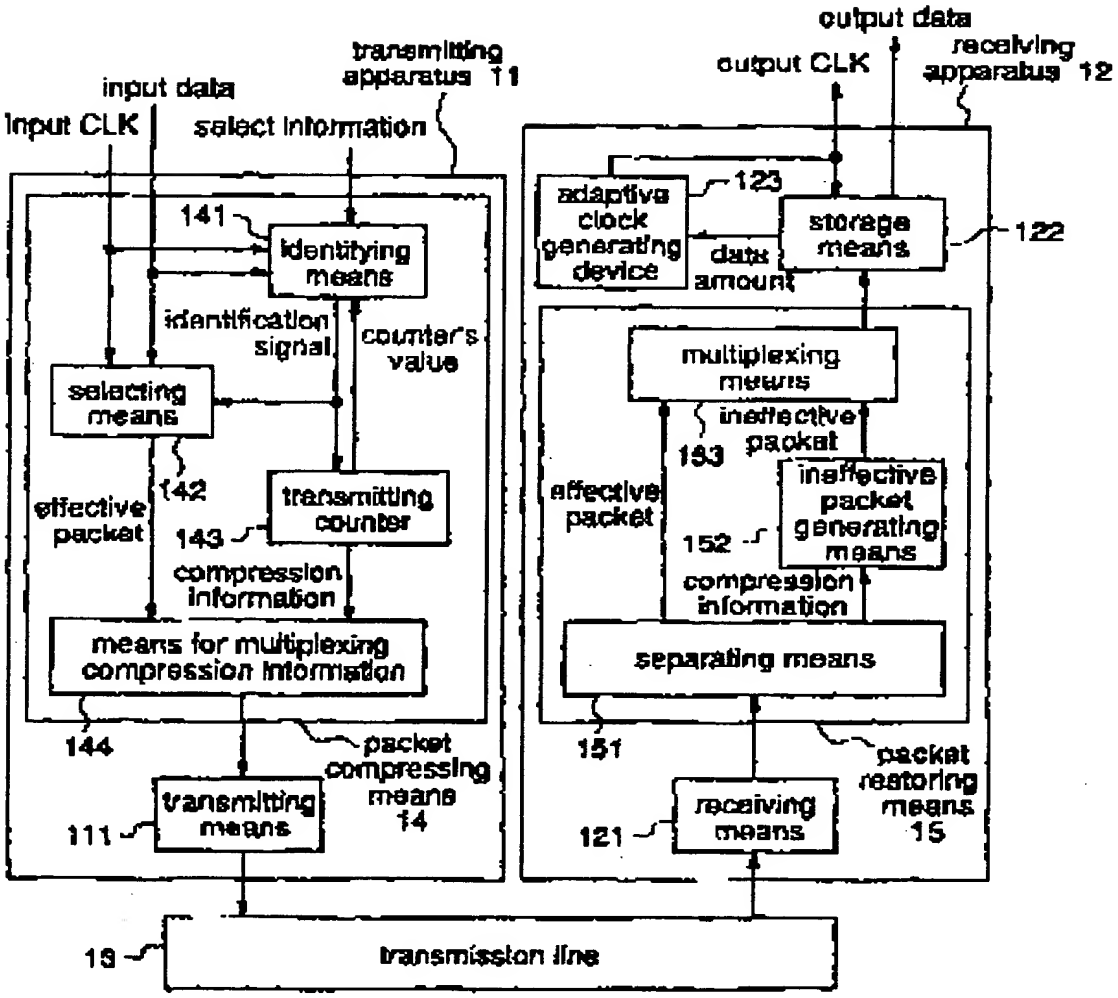

transmitting apparatus 11
input data
Input CLK
select information
141
identifying means
identification signal
counter's value
selecting means
142
effective packet
transmitting counter
143
compression information
means for multiplexing compression information
144
packet compressing means 14
transmitting means
111
output data
output CLK
receiving apparatus 12
adaptive clock generating device
123
storage means
122
data amount
multiplexing means
ineffective packet
153
ineffective packet generating means
152
effective packet
compression information
separating means
151
packet restoring means 15
receiving means
121
transmission line
13

Fig.2

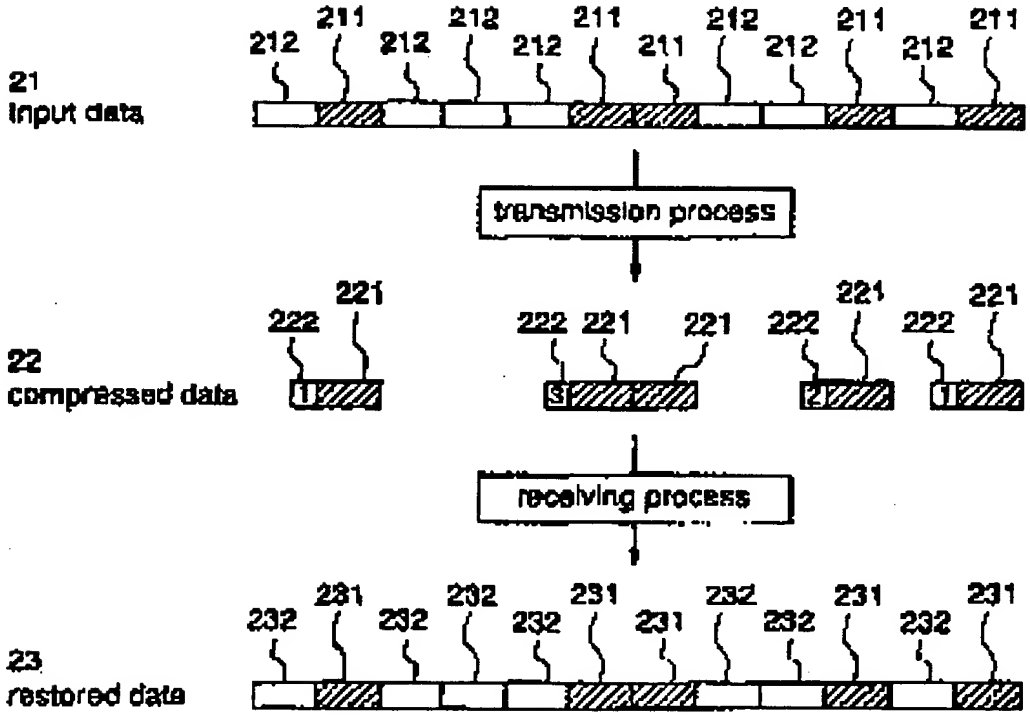

21
input data
212
211
212
212
212
211
211
212
212
211
212
211
transmission process
22
compressed data
222
221
222
221
221
222
221
222
221
receiving process
23
restored data
232
231
232
232
232
231
231
232
232
231
232
231

Fig.3 (a)

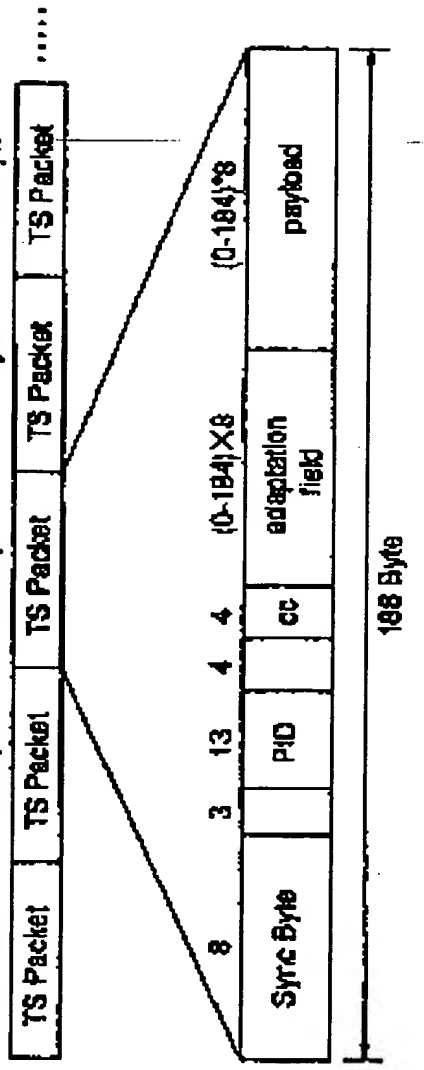

MPEG-TS
188 Byte
TS Packet
188 Byte
TS Packet
188 Byte
TS Packet
188 Byte
TS Packet
.....
8
Sync Byte
3
13
PID
4
4
CC
(0-184)X8
adaptation field
(0-184)*8
payload
188 Byte

Fig.3 (b)

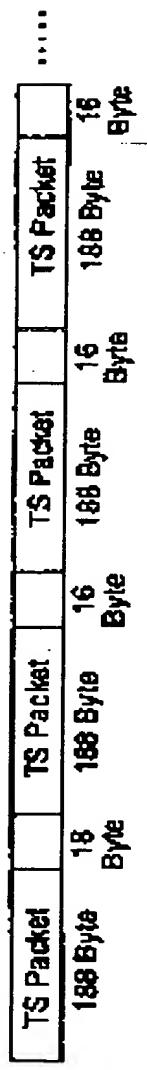

MPEG-TS (204 Byte Mode)
TS Packet
188 Byte
16 Byte
TS Packet
188 Byte
16 Byte
TS Packet
188 Byte
16 Byte
TS Packet
188 Byte
16 Byte
.....

Fig.4

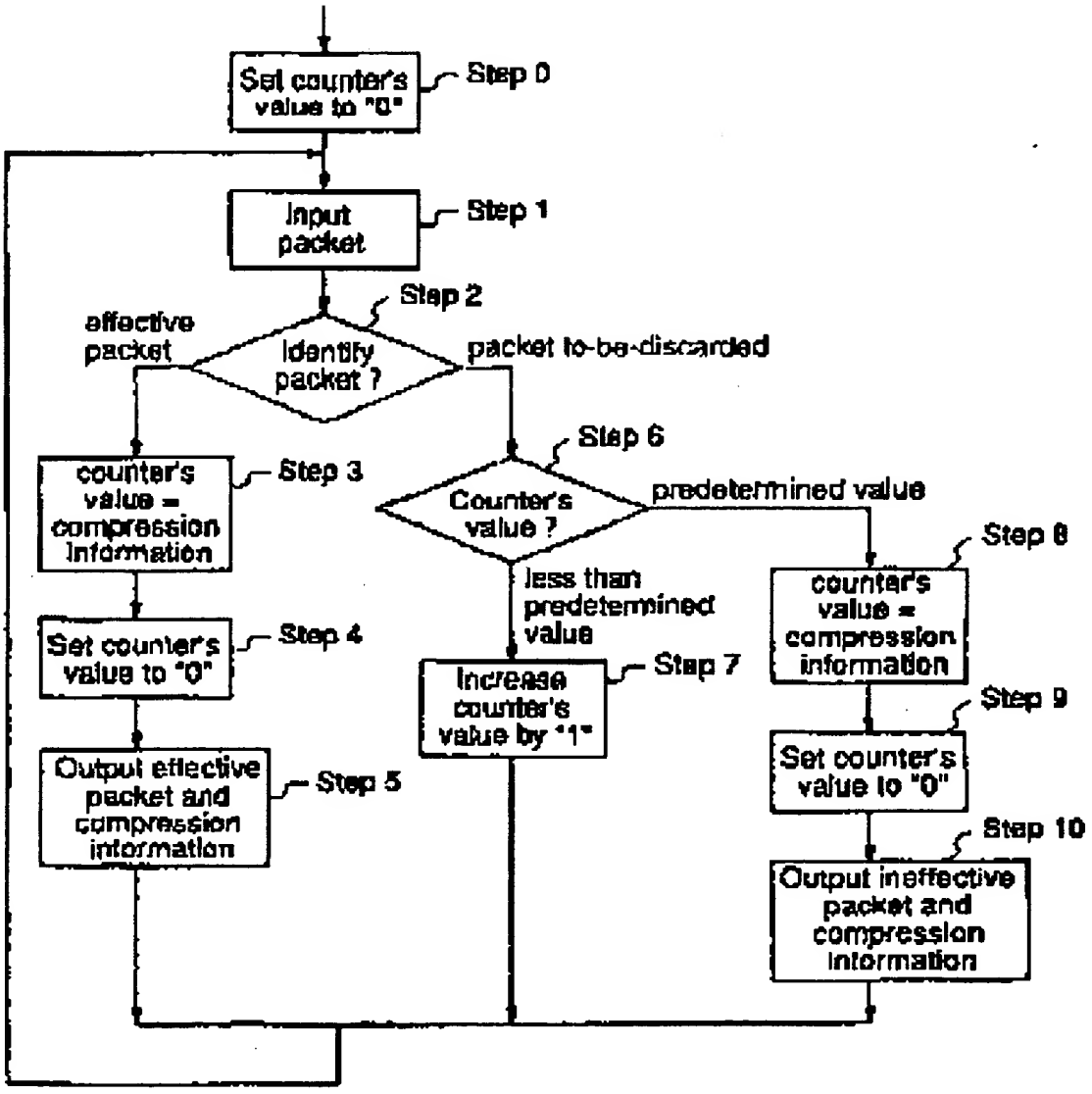

Set counter's value to "0"
Step 0
Input packet
Step 1
Step 2
effective packet
Identify packet ?
packet to-be-discarded
counter's value = compression information
Step 3
Set counter's value to "0"
Step 4
Output effective packet and compression information
Step 5
Step 6
Counter's value ?
predetermined value
less than predetermined value
Increase counter's value by "1"
Step 7
counter's value = compression information
Step 8
Set counter's value to "0"
Step 9
Output ineffective packet and compression information
Step 10

Fig.5

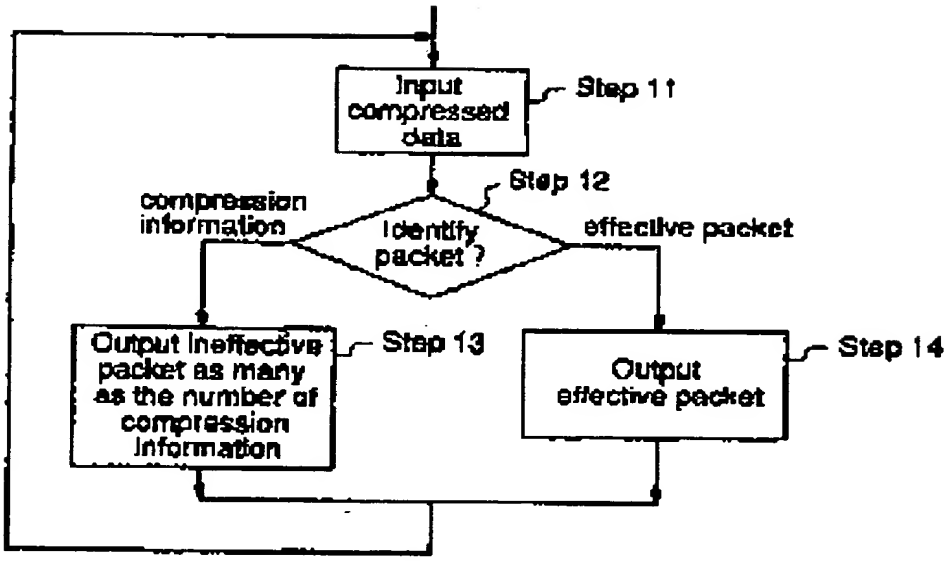

Input compressed data
Step 11
Step 12
compression information
Identify packet ?
effective packet
Output ineffective packet as many as the number of compression information
Step 13
Output effective packet
Step 14

Fig.6

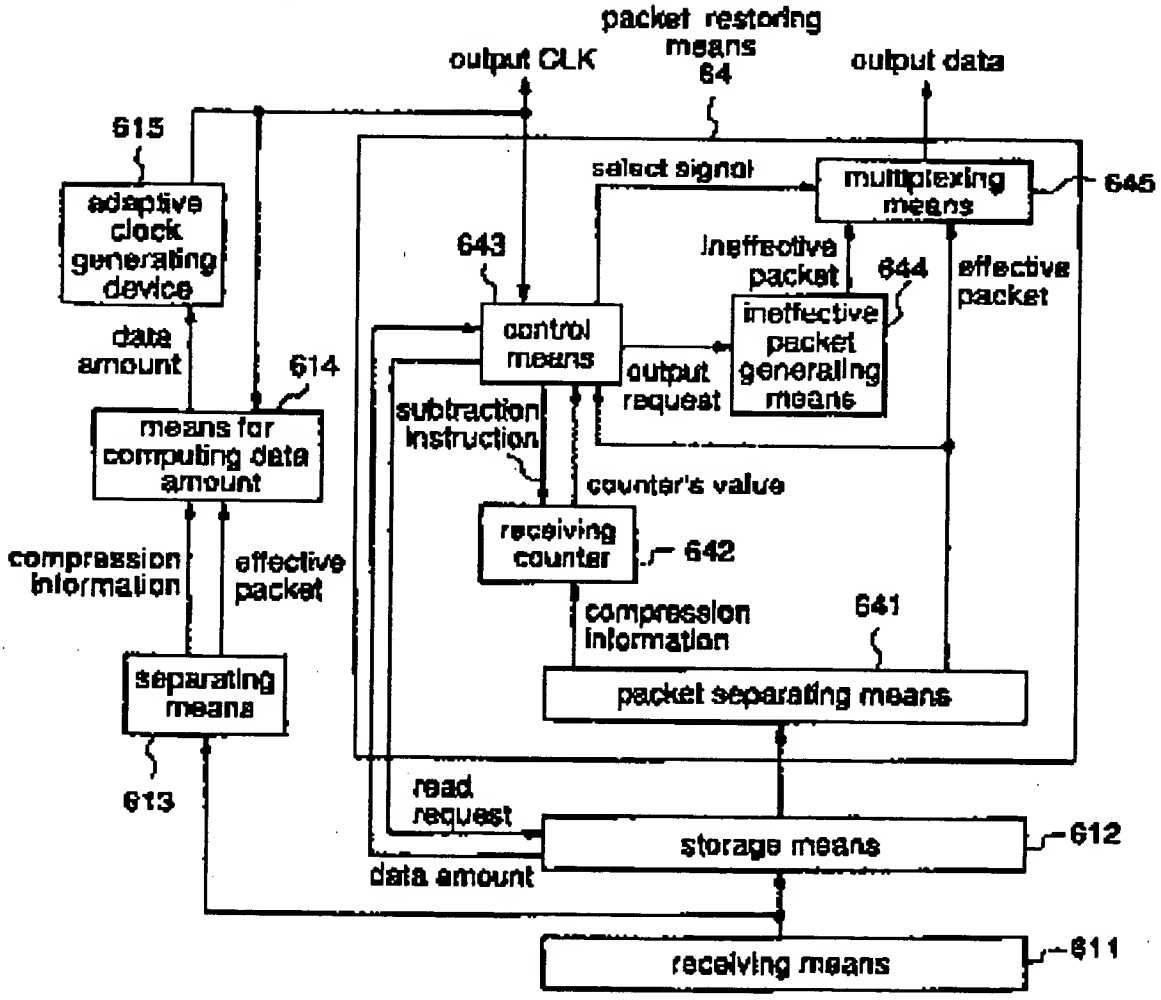
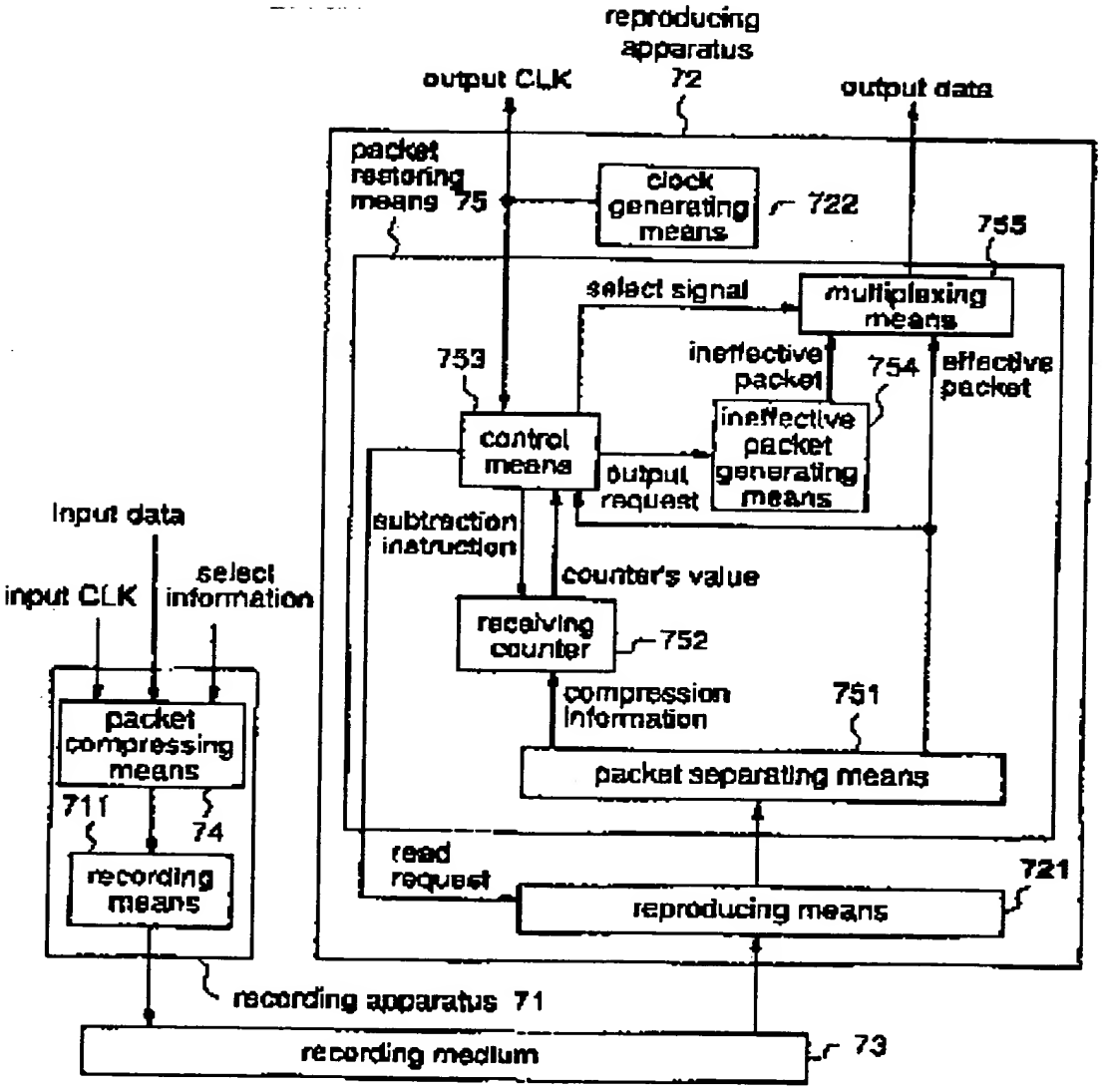

packet restoring means 64
output CLK
output data
615
adaptive clock generating device
select signal
multiplexing means
645
643
ineffective packet
644
effective packet
control means
ineffective packet generating means
data amount
614
output request
means for computing data amount
subtraction instruction
counter's value
receiving counter
642
compression information
effective packet
641
compression information
packet separating means
separating means
613
read request
storage means
612
data amount
receiving means
611

Fig.7


reproducing apparatus 72
output CLK
output data
packet restoring means 75
clock generating means
722
755
select signal
multiplexing means
753
ineffective packet
754
effective packet
ineffective packet generating means
control means
output request
subtraction instruction
counter's value
receiving counter
752
compression information
751
packet separating means
read request
721
reproducing means
Input data
input CLK
select information
packet compressing means
711
74
recording means
recording apparatus 71
recording medium
73

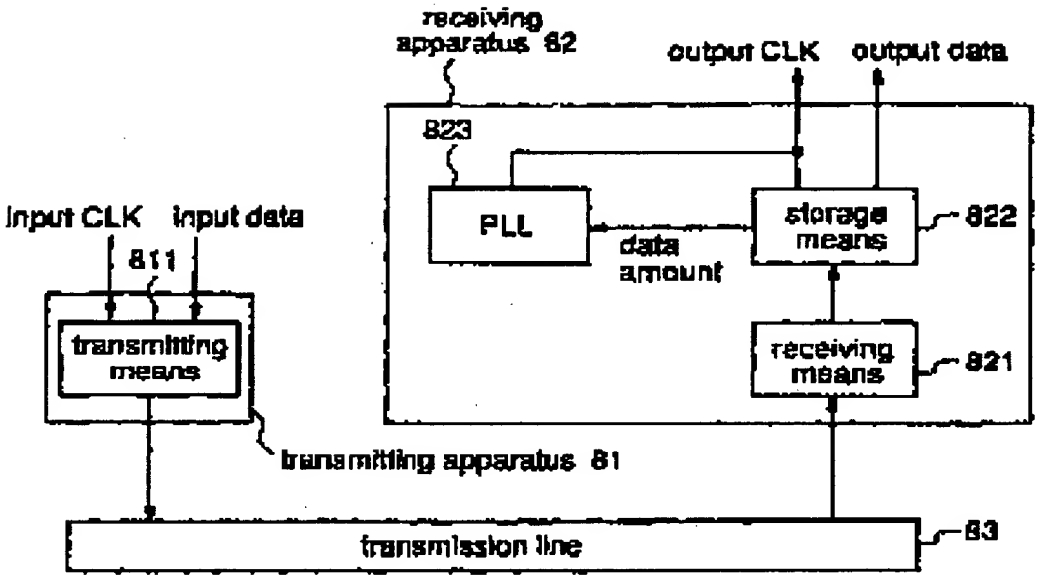



Fig.8 Prior Art